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MAGNETIC RECORDING MEDIUM MANUFACTURING METHOD

CLAIM(S)

A magnetic recording medium manufacturing method comprising the following steps: a magnetic recording layer and a protective layer are formed successively on a non-magnetic substrate that is roughened on the surface; said protective layer surface is put to polishing treatment and cleaning treatment to remove fine bumps from said protection layer surface; a lubricant layer is formed on said protective layer that has gone through the cleaning treatment; and said method being characterized in that said lubricant layer is formed within 30 minutes after said cleaned protective layer surface has been washed with water and dried.

DETAILED DESCRIPTION OF THE INVENTION

(0001)

(Field of Industrial Application)

The present invention pertains to a method to manufacture a magnetic recording medium having, on its non-magnetic substrate, a magnetic

recording layer, a protective layer, and a lubricant layer, and used for a magnetic disk device that uses a contact-start-stop (CSS) system.

(0002)

(Prior Art)

When a magnetic recording medium used for a magnetic device using a CSS system was manufactured by the prior art, the magnetic recording layer was formed on the substrate after a lapping process, a polishing process, and a texture process were applied to the non-magnetic substrate to roughen the surface; subsequently, a protective layer made or carbon or SiO_2 was formed on the magnetic recording layer; then, the polishing process and the cleaning process were applied to the protective layer to remove the fine bumps which were created on the protective layer surface correspondingly to the roughened state of said non-magnetic substrate; finally, a lubricant layer was formed on said protective layer.

(0003)

In recent years, as magnetic recording media move to higher and higher density, a space between a recording medium and a magnetic head is getting increasingly narrow. Accordingly, in order to set the floatation height of a magnetic head at a low level from a magnetic recording medium, the roughness level on the surface must be reduced when said texture

processing is applied. By this, however, the contact dimensions of the magnetic recording medium and of the magnetic head increase, increasing the friction of said contact dimensions, which causes a problem that the magnetic recording medium and the magnetic head tend to be scratched and cannot be used for a long time.

(0004)

(Problems of the Prior Art to Be Addressed)

To solve the aforementioned problems, the objective of the present invention is to present a magnetic recording medium manufacturing method, whereby a magnetic head and a magnetic recording medium are not scratched even if the floatation height of the magnetic head is set at a low level from the magnetic recording medium surface.

(0005)

(Means to Solve the Problems)

In the magnetic recording medium manufacturing method that accomplishes the aforementioned objective in the present invention, the protective layer surface that has gone through the polishing treatment and cleaning treatment is washed with water and dried, and subsequently, the lubricant layer is formed on it within 30 minutes.

(Operation)

In the method of the present invention, for the material of the non-magnetic substrate, a hard non-magnetic material, e.g., a non-magnetic metal such as aluminum alloy, glass, and resin, is used. Over the entire surface of the substrate made of such a material, is formed a hardened layer, which has high rigidity and can be cut well. This hardened layer is formed by, for example, installing an Ni-P alloy layer or Ni – Cu – P alloy layer by an electroless plating method on the protective layer. Or alumetizing treatment can be applied if an aluminum alloy is used for the substrate.

(0007)

To the substrate on which the hardened layer is made, a polishing process, such as a lapping process or a polishing process, is applied to planarize the surface. The surface of the substrate that has gone through the polishing process for planarization is roughened by using a texture process.

(0008)

On this substrate, after a backing layer made of Cr or Cr alloy is formed to adjust the magnetic characteristics of the magnetic recording layer if necessary, a the magnetic recording layer made of ferromagnetic metal thin film, such as that of Co group, Co-Ni group, Co-Pt group, Co – Cr – Ta group, or Fe group, is formed.

(0009)

On the magnetic recording layer, a carbon, SiO_2, SiN, SiAlON, or ZrO_2 film is formed to protect the magnetic recording layer, as in the prior art method. On the protective layer surface thus formed, fine bumps corresponding to the roughness of said non-magnetic substrate have been generated, so the protective layer surface needs to be put to polishing and cleaning treatments. For the polishing treatment, a polishing tape is used. For the cleaning treatment, can be used a cleaning tape made of cotton or polyester non-woven cloth, preferably, the cleaning tape, which is previously presented by the inventors of the present invention (in Japanese Patent Applications 03-331682 and 03331683), and which is constructed by woven cloth of polyester and/or polyamide ultra fine fiber yarn and has wedge-shaped indentations along the outer peripheries of the ultra fine fiber yarns and/or between the woven ultra fine fiber yarns.

(0010)

In the method of the present invention, it is important that the lubricant layer is formed after the polished and cleaned protective layer surface is washed with water and dried. This washing with water can dramatically improve the durability of the magnetic recording medium, more specifically, the result of the CSS test. It is presumed that if the

lubricant layer is adhered to the protective layer surface before the protective layer is washed with water and the protective layer is formed without being washed, the adhesion strength of the lubricant layer to the protective layer will be reduced, making the lubricant layer easily releasable from the protective layer, but if the polished and cleaned protective layer surface is washed with water, gasified ultra fine impurities, such as hydrocarbon, in the cleaning room atmosphere will be washed away with water.

(0011)

To wash the protective layer surface with water, it may be immersed in the purified water at the temperature between a normal temperature and 700C for 1 minute – 2 hours, but it will be more effective if ultrasonic wave is applied to the protective layer surface. The quality of the water used is not limited to a specific type, but it is preferable to use the water having high resistivity and little organic substances, fine particles, and oxygen dissolved in it.

(0012)

The protection layer, the surface of which has been washed with water, is dried, preferably, spin-dried, and subsequently, the lubricant layer, such as that of perfluoroalkyl polyether, is formed within 30 minutes; thus,

the desired magnetic recording medium is manufactured. If the lubricant layer is formed in more than 30 minutes after drying, said impurities adhered in the clean room atmosphere before washing with water will be adhered again, so it is important that the lubricant layer is formed within 30 minutes.

(0013)

(Embodiment Examples)

(Embodiment Example 1)

An Ni – P alloy layer was formed by electroless plating on a circular substrate having the diameter of 3.5 inches and made of aluminum alloy (4 weight percent of Mg and Al for the remaining portion). A lapping process and a polishing process were applied to the substrate surface to make the medium substrate having the surface roughness Rmax 300Δ or less (the distance from the peak height to the bottom depth within the standard length). The polishing tape, on the base of which alumina grinding particles with average particle size 6 Φm are bonded, was pressed against the substrate surface having said roughness level at a constant force to create the texture; thus, ultra fine concentrical grooves with the surface roughness Ra 60 Δ were made.

(0014)

Subsequently, on this substrate, a Cr backing layer with 500 Δ thickness was formed by sputtering. On this backing layer, the Co – Cr – Ta group magnetic recording layer with 500 Δ thickness was formed. On top of this magnetic recording layer, the carbon protective layer with 200 Δ thickness was formed by a sputtering method using an amorphous carbon target (Ar gas pressure 6 m Torr, DC power 20 W/cm_2).

(0015)

While the substrate with the carbon protective layer formed was being rotated at 2000 rpm, the polishing tape, in which alumina grinding particles with average particle size 2 Φm are bonded to its polyester base film, was contacted with said carbon protective layer to perform the polishing process. Subsequently, the carbon protective layer was cleaned with the cleaning tape made of woven cloth of nylon and polyester fine fiber yarn ("Zabiina Minimax," wiping cloth made by Kanebo Co.).

(0016)

The substrate thus cleaned was, after having been set aside for 3 hours, immersed in the purified water of 65EC to be washed (resistivity 15 MΣ/cm at 25EC; organic substances 0.1 weight ppm or less; 10 particles

with 0.2 Φm or larger size/ml; 8 weight ppm of dissolved oxygen), followed by spin drying at 5000 rpm rotation speed.

(0017)

On the protective layer that has been spin-dried, the perfluoropolyether group lubricant ("Kuraitokkus" by Dupont Co.) was coated to form the lubricant layer with 25 Δ thickness.

(0018)

The magnetic recording medium thus made was subjected to the CSS test to evalute its duration. More specifically, after the magnetic recording medium was set on a rotary spindle, the thin film magnetic head (slider material: Al_2O_3-TiC; slider size: 3.20 mm long and 2.66 mm wide; load: 7.2 kg) was positioned at radius 20 mm of the magnetic recording medium, and the process of O rpm (the state wherein the thin film magnetic head is contacting with the magnetic recording medium surface) Ψ 3600 rpm (the state wherein the thin film magnetic head is floating from the magnetic medium surface at floatation height 0.10 Φm) Ψ 0 rpm (the state wherein the thin film magnetic head has returned to the contacting position) was repeated at a cycle of 30 seconds. Then, the friction coefficient of the magnetic recording medium at the starting point and that after the CSS was

repeated by 100,000 times were measured. The results were 0.20 and 0.28, respectively.

(0019)

(Embodiment example 2)

The same test was conducted as in Embodiment Example 1 except that the substrate was washed with water immediately after the cleaning treatment. The friction coefficient after 100,000 times of CSS was 0.28.

(0020)

(Embodiment Example 3)

The same test was conducted as in Embodiment Example 1 except that the cleaning tape made of non-woven cloth of 100% polyamide was used for cleaning. The friction coefficient after 100,000 times of CSS was 0.30.

(0021)

(Comparative Example 1)

The same test was conducted as in Embodiment Example 1 except that the lubricant layer was formed on the substrate that was set aside for 3 hours after cleaning but was not washed and dried. The friction coefficient after 100,000 times of CSS was 0.85.

(0022)

(Comparative Example 2)

The same test was conducted as in Comparative Example 1 except that the lubricant layer was formed immediately after the cleaning treatment. The friction coefficient after 100,000 times of CSS was 0.43.

(0023)

(Advantage)

As is evident from the above explanation, according to a magnetic recording medium manufacturing method of the present invention, a magnetic head and a magnetic recording medium are not scratched even if the floatation height of the magnetic head is set at a low level from the magnetic recording medium surface.